Title: Counting Crocodiles

Brief Overview:

This math unit is a literature-based unit for grades 2 and 3. It includes an emphasis on number patterns and relationships, addition, repeated addition, multiplication, if taught, measurement in metric units and problem solving.

NCTM 2000 Principles for School Mathematics:

- **Equity:** *Excellence in mathematics education requires equity - high expectations and strong support for all students.*
- **Curriculum:** *A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*
- **Teaching:** *Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*
- **Learning:** *Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.*
- **Assessment:** *Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*
- **Technology:** *Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

Links to NCTM 2000 Standards:

- **Content Standards**

Number and Operations

- *Understand numbers through representation, numbers, relationships among numbers, and number systems.*
- *Understand meanings of operations and how they relate to one another; understand various meanings of addition and multiplication; understand the effects of adding and multiplying whole numbers; and identify and use relationships between operations, such as repeated addition and multiplication to solve problems.*
- *Compute fluently and make reasonable estimates; develop fluency in adding and multiplying whole numbers; develop and use strategies to estimate the results of whole-number computations and to judge the reasonableness of such results; and use visual models, benchmarks, and equivalent forms to add and multiply whole numbers.*

Algebra

- *Understand patterns, relations, and functions; and describe, extend, and make generalizations about numeric patterns.*
- *Use mathematical models to represent and understand quantitative relationships; and model problem situations with objects and use representations and equations to draw conclusions.*
- *Analyze change in various contexts; and identify and describe situations with constant or varying rates of change and compare them.*

Geometry

- *Specify locations and describe spatial relationships using coordinate geometry and other representational systems; and find the distance between points along horizontal and vertical lines of a coordinate system.*
- *Use visualization, spatial reasoning, and geometric modeling to solve problems; and use geometric models to solve problems in other areas of mathematics, such as numbers and measurement.*

Measurement

- *Understand measurable attributes of objects and the units, systems, and processes of measurement; and understand that measurements are approximations and how differences in units affect precision.*

- **Process Standards**

Problem Solving

- *Instructional programs from prekindergarten through grade 12 should enable all students to build new mathematical knowledge through problem solving; solve problems that arise in mathematics and in other contexts; apply and adapt a variety of appropriate strategies to solve problems; and monitor and reflect on the process of mathematical problem solving.*

Reasoning and Proof

- *Instructional programs from prekindergarten through grade 12 should enable all students to recognize reasoning and proof as fundamental aspects of mathematics; make and investigate mathematical conjectures; develop and evaluate mathematical arguments and proofs; and select and use various types of reasoning and methods of proof.*

Communication

- *Instructional programs from prekindergarten through grade 12 should enable all students to organize and consolidate their mathematical thinking through communication; communicate their mathematical thinking coherently and clearly to peers, teachers, and others; analyze and evaluate the mathematical thinking and strategies of others; and use the language of mathematics to express mathematical ideas precisely.*

Connections

- *Instructional programs from prekindergarten through grade 12 should enable all students to recognize and use connections among mathematical ideas; understand how mathematical ideas interconnect and build on one another to produce a coherent whole; and recognize and apply mathematics in contexts outside of mathematics.*

Representation

- *Instructional programs from prekindergarten through grade 12 should enable all students to create and use representations to organize, record, and communicate mathematical ideas; select, apply, and translate among mathematical representations to solve problems; and use representations to model and interpret physical, social, and mathematical phenomena.*

Grade/Level:

Grades 2 - 3, all levels

Duration/Length:

Four-five days, extension activities available for Day 6

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Patterns, estimation, addition, repeated addition, doubling of numbers, multiplication, and metric measurement
- Process standards - problem solving, communication, reasoning, and connections

Student Outcomes:

Students will:

- listen to a story and identify the pattern being represented.
- identify and represent numbers using patterns and operational relationships between addition and multiplication.
- reasonably estimate the distance between two points using different centimeter lengths for comparison.
- measure the distance between two points using centimeter lengths.
- work in cooperative groups to solve problems.
- communicate mathematically in written form.

Materials/Resources/Printed Materials:

- Counting Crocodiles, by Judy Sierra, Gulliver Books Harcourt Brace and Company, 1997
- Teacher Resources - overhead transparencies made by teacher from Student Resource Sheets
- Student Resources:
  - Croc Rods Pattern Student Resource Sheet #1
  - Croc Rod Grid Paper Student Resource Sheet #2
  - Rubric for Journal Writing Student Resource Sheet #3
  - Croc Walk Estimation Student Resource Sheet #4
  - Croc Walk Map Student Resource Sheet #5a
  - Croc Walk Map Student Resource Sheet #5b
  - Croc Walk Reflection Student Resource Sheet #6
  - Island Hopping Map Student Resource Sheet #7a
  - Island Hopping Map Student Resource Sheet #7b
  - Island Hopping Student Resource Sheet #8
  - Colored Pencils or Crayons, nine different colors
  - Scissors
  - Glue stick or glue
  - Ziplock Baggies - 1 per student

Development/Procedures:

DAY ONE

- Introduce the book entitled: Counting Crocodiles, by Judy Sierra.
  As the story is being read, ask students to look for mathematical patterns in the story.

Possible Questions:

1. What problem did the monkey have in the story?
   (The monkey could not reach the other island to get the bananas because of the hungry crocodiles.)

2. How did the monkey trick the crocodiles so he could reach the other island?
   (He tricked the crocodiles into lining up back to back so he could walk across their backs.)

- Distribute one sheet of Croc Rod Pattern Student Resource #1 and Croc Rod Grid Paper Student Resource Sheet #2 per student.
  Note: You could give Croc Rod Pattern Student Resource #1to students the day before to color and cut out at home. Give each student a ziplock baggie to put the rods in.

- Have students cut out the Croc Rods, cutting on the lines as close as possible.

- Discuss how the crocodiles lined up for the monkey to count them.
  Re-read the section in the book where the crocodiles are lining up so students have better comprehension.

Possible Questions:

1. Do you see a pattern in how the crocodiles lined up?

2. How did the author represent the crocodiles in the book?
   (By counting up and then reversing the pattern.
   1,2,3,4,5,6,7,8,9,10,10,9,8,7,6,5,4,3,2,1)

- Have students construct a staircase representing the crocodiles in the story, using Croc Rod Pattern Student Resource Sheet #1 and Croc Rod Grid Paper Student Resource Sheet #2.
  Circulate and help students as needed.
  Once everyone has represented the pattern on the grid, have students talk to a neighbor about what they observed.
  Share with the class. Elicit that the pattern is increasing by 1's, stops at 10, and decreases by 1's. Write answers on the board.

- Share with students that the monkey is having a lot of trouble counting the actual number of crocodiles. Our job is to help the monkey count the crocodiles.

Possible Questions:

1. How can we help the monkey count the crocodiles?
   (Use Croc Rods; write number sentences using addition; count the centimeter squares, etc.)

2. Revisit the text to determine the number of crocodile families.
   (Actually, it is one family, but students may not see that immediately.)

- Discuss possible ways of solving the problem. Let students work independently or with a partner to solve for the actual number of crocodiles.
  (Actual number of crocodiles is 55.)

  Possible Questions:
  1. Could you move the Croc Rods around to help you count the crocodiles?
     (Make groups of ten out of the rods. Example: Move the 2 cm Croc Rod over to 8 cm Croc Rod, etc.)

  2. What would the number sentence look like?
     (1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 = 55 or 10 + 10 + 10 + 10 + 10 + 5 = 55)

- Once all students have discovered the number of crocodiles, open a discussion about doubling.

  Possible Question:
  How could we help the monkey count all the crocodiles if another family of crocodiles, of exactly the same size, came swimming up? We want to teach the monkey an easier way of counting all of the crocodiles, without having to line them all back up.
  (repeated addition 55 + 55 = 110 crocodiles, multiplication 55 x 2 = 110 crocodiles.)

- As an assessment of Day 1 have students do a journal writing.

  Distribute Math Journal Writing Student Resource Sheet #3 and Journal Writing Rubric Student Resource Sheet #4 to students. Discuss rubric with students before they begin writing. Begin in class and finish for homework if time is limited.

  Journal Writing - In words, numbers and pictures explain how you solved the problem to find the exact number of crocodiles.

DAY TWO

- Review the book, Counting Crocodiles.

  Possible questions:
  1. What was on the island where the monkey lived? *(lemons)*
  2. What was on the island where the monkey wanted to go? *(bananas)*
  3. What was the problem? *(There were hungry crocodiles in the way.)*

- Pass out the Croc Walk Estimation Sheet Student Resource Sheets #5, Croc Walk Map Student Resource Sheet #6a, Croc Walk Map Student Resource Sheet #6b, and Croc Walk Reflection Student Resource Sheet #7.
  Have students glue or tape Croc Walk Map Student Resource Sheet #6a and Croc Walk Map Student Resource Sheet #6b together. Consider having a class set made and laminated.
  Referring back to the story, discuss where the monkey started and where he wanted to go.
  (The monkey wanted to go from Lemon Island to Banana Island to eat the bananas.)

- Students will take out the green Croc Rod from Croc Rod Pattern Student Resource Sheet #1.

- Teacher may use the overhead to model for students as they begin using the map following directions below.

  Instruct students that they are going to use the green Croc Rod to find out how many crocodile backs the monkey must cross to reach the other island on Croc Walk Map Student Resource #6a and #6b. This can also be thought of as measuring the distance between the two islands.

  Introduce Croc Walk Estimation Sheet Student Resource Sheet #5. Share that students will use this worksheet throughout Croc Walk Activity.

  1. Students will carefully look at the size of the green Croc Rod.
  2. Using Croc Walk Estimation Sheet Student Resource Sheet #5 have students color in the length or trace the outline of the green Croc Rod. Check for accuracy by having students place the Croc Rod over their colored work.
  3. Everyone will estimate the number of green Croc Rods it will take to go from Lemon Island to Banana Island. Use Croc Walk /Map Student Resource Sheets #6a and 6b to look at the distance between the two islands. Students will write their estimate on Croc Walk Estimation Sheet Student Resource Sheet #5. The teacher will write all estimates on overhead projector or board.
  4. Students will use the green Croc Rod to measure the actual distance between the two islands. Instruct students to use the top pathway on Student Resource #6a and 6b to trace the actual number of Croc Rods needed to go from Lemon Island to Banana Island. Teacher will model on overhead.
     Students will place the green Croc Rod next to Lemon Island. Have them hold down the Croc Rod with one hand while tracing around the perimeter of the rod with a pencil only.
     Then students will pick up the rod, continuing to place and trace the path until they reach Banana Island.
     On Croc Walk Estimation Sheet Student Resource Sheet #5 students will write the actual number of rods used to reach Banana Island.
  5. The teacher will ask students to compare their actual findings to their estimates using Croc Walk Estimation Sheet Student Resource Sheet #5.
     Finally, the teacher will model writing a number sentence to describe the number of Croc rods used to reach Banana Island.
     Have students write a number sentence above the green traced path used to reach Banana Island.
     (Example: 4 green croc rods is the same as 6+6+6+6=24 or 6 x 4 = 24 because the green Croc rod is 6 cm long.)
     Help students make the connection between the visual representation of the rods and the number sentence.

- Students will then follow the same procedures 1 - 5 with the orange rod using the middle pathway on Croc Walk Map Student Resource Sheets #6a and 6b.

  ADDITIONAL STEP: Before estimating the distance with the orange rod, compare the length of the orange rod to the green rod to help to determine if the amount of rods will be more or less.

Possible Questions:

1. What relationships do students see between the two rods?
   (half as big, less than, smaller, etc.)

2. How can you use the relationships seen between the two rods to make an actual estimate? Have students write their estimate on Croc Walk Estimation Sheet Student Resource Sheet #5.

- Finally, have students choose their own color rod to compare the distance between the two islands.

1. Each student will choose a rod not already used and trace it on Croc Walk Estimation Sheet Student Resource Sheet #5.
2. Students will compare their rod to the green Croc Rod and use this comparison to estimate the distance between the islands. Have students write down their estimate on Croc Walk Student Resource Sheet #4.
3. Measure the actual distance by placing and tracing the distance to Banana Island using the bottom pathway. Write the number of Croc Rods used on the Croc Walk Estimation Sheet Student Resource Sheet #5.
4. Have students write the number sentence that corresponds to the distance measured with the rod they chose above the bottom pathway on Croc Walk Map Student Resource Sheets 6a and 6b.

- Have students complete the Croc Walk Reflection Student Resource Sheet #7. This may be used as an assessment tool for teachers. This will measure if students are able to communicate the relationships observed and the estimations made between the various rods.

Performance Assessment:

Directions:

- Prepare map by distributing The Island Hopping Map Sheets, Student Resource Sheets # 8a and 8b, to each student and have students tape or paste together on the dotted line.
- Pass out Island Hopping Resource sheet, Student Resource Sheet #9, to record information.
- Use Croc Rods, Student Resource Sheet #1, from previous activities.
- Students will use their Croc Rods to independently measure distances between islands as per directions on the Student Resource sheet and independently answer questions.
    1. Students will measure the distance from island to island using the Croc Rod specified in each direction.
    2. Students will trace the rods used to measure distances as demonstrated and practiced on previous days.
    3. Students will record on their Island Hopping answer sheet, Student Resource Sheet #9, the number of rods used and write the correlating number sentences.
    4. Discuss observations with students as they progress through the worksheet. Elicit that it may become easier to estimate with each question that they investigate.

Extension/Follow Up:

EXTENSION AND ENRICHMENT ACTIVITIES

1. Map Activities
    - Create map. Have partner measure distances, using Croc rods.
    - Students can take an island tour using the Island Hopping map, measuring the total distances around all the islands, beginning at Croc Island.

2. Math
    - Measure area of classroom objects using Croc Rods.

3. Language Arts Activities
    - Have students write a story using illustrations about an imaginary journey to an island.
    - Enrich this lesson by having students create a play or puppet show using the characters in the story, *Counting Crocodiles* by Judy Sierra.
    - Students can read other books by Judy Sierra.

4. Science Activities
    - Provide the students access to computers to research monkeys or crocodiles.
    - Have students research the difference between crocodiles and alligators and give a report to the class.

5. Social Studies Activities
    - Enrich the lesson by having students research the location of monkeys and crocodiles; then create a map.

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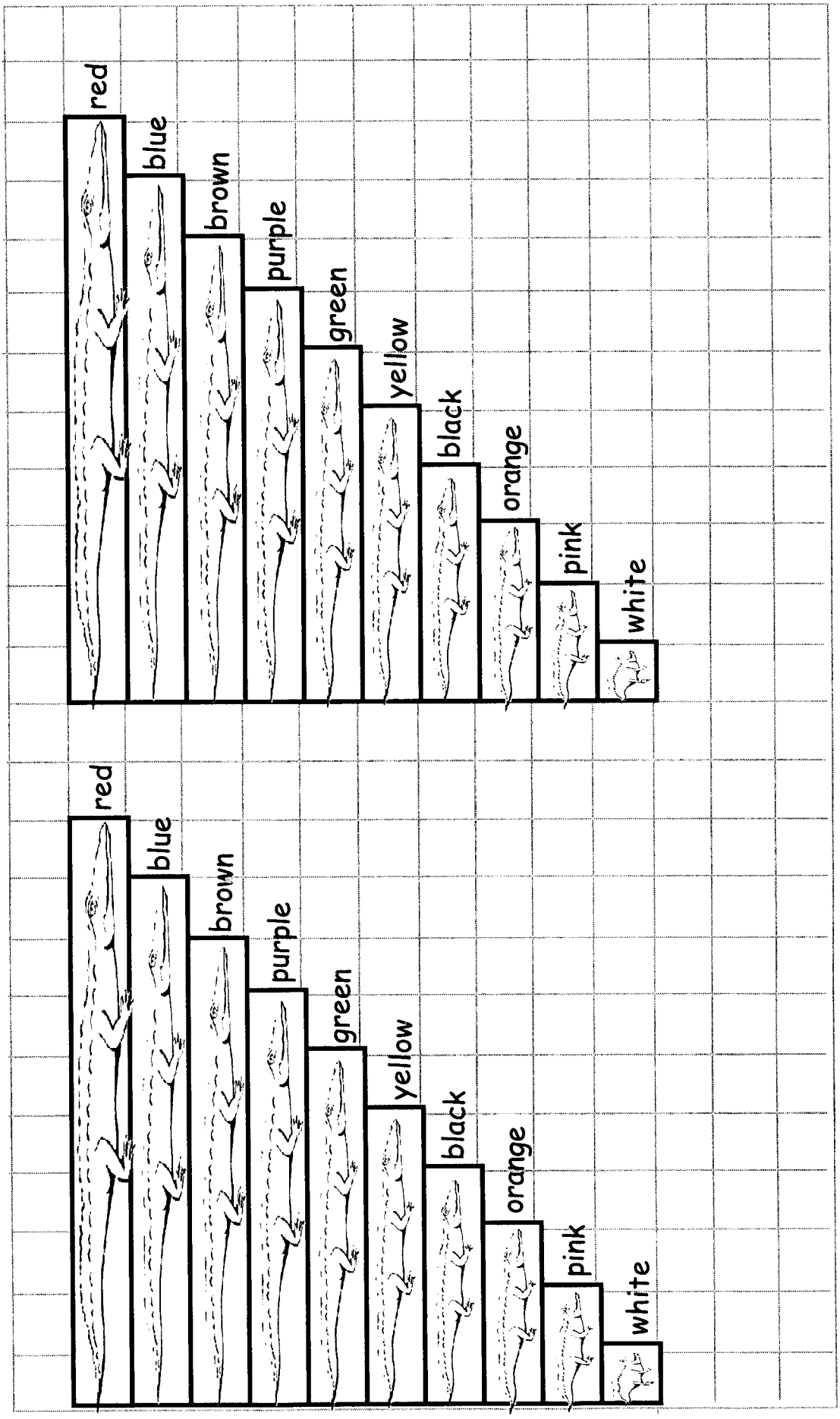
Croc Rods Pattern Sheet

Student Resource Sheet#1

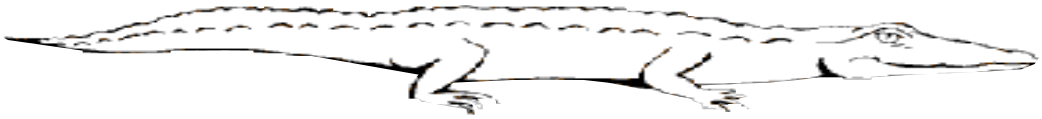


Croc Rod Grid Paper

Student Resource #3

Name_____ **Date**_____

Math Journal Writing



In words, numbers, and pictures, explain how you solved the problem of finding the exact number of crocodiles in the story, COUNTING CROCODILES. Counting by 1's is not the strategy called for here. See attached rubric.

Remember there were _____ crocodiles in all.

_____

_____

_____

_____

_____

_____

Name_____

Rubric for Journal Writing

3 points-- I explained how I solved to find the exact number of crocodiles if another family of crocodiles came visiting by using all of the choices below.

I used:
_____words
_____pictures
_____numbers
_____very clear explanation for reader!

2 points-- I explained how I solved to find the exact number of crocodiles if another family of crocodiles came visiting by using 2 of the following 3 choices.

I used:
_____words
_____pictures
_____numbers
_____somewhat clear explanation for reader!

1 points-- I explained how I solved to find the exact number of crocodiles if another family of crocodiles came visiting by using 1 of the following 3 choices.

I used:
_____words
_____pictures
_____numbers
_____not a clear explanation for reader!

Croc Walk Estimation Sheet

Name _____

Rod Used	Color in the Length of the Rod	Estimate Number of Rods to Other Island	Actual Number of Rods
Green Rod (6 cm)		_____	_____
Orange Rod (3 cm)		_____	_____
The Rod You Chose		_____	_____

Croc Walk Map

Lemon Island

Green

Orange

Your Choice

Glue here

Left Side of Croc Walk Map

Student Resource #6B

Student's Name: _____

Cut here

Banana Island

Right Side of Croc Walk Map

Croc Walk Reflection

Use the data from your Crocodile Walk worksheet to answer the following questions:

1) The rod I chose was _____

2) My estimate was

- ☐ close
- ☐ inaccurate
- ☐ accurate

3) Compare the length of the Croc rod you selected to the green Croc rod. What did you observe?

_____

_____

_____

_____

_____

4) Using the Croc rod you selected, did it take more or less Croc rods to reach the other island? Explain your answer.

_____

_____

_____

_____

_____

Northwest Section

Coconut Island

7

Frog Island

6

Butterfly Island

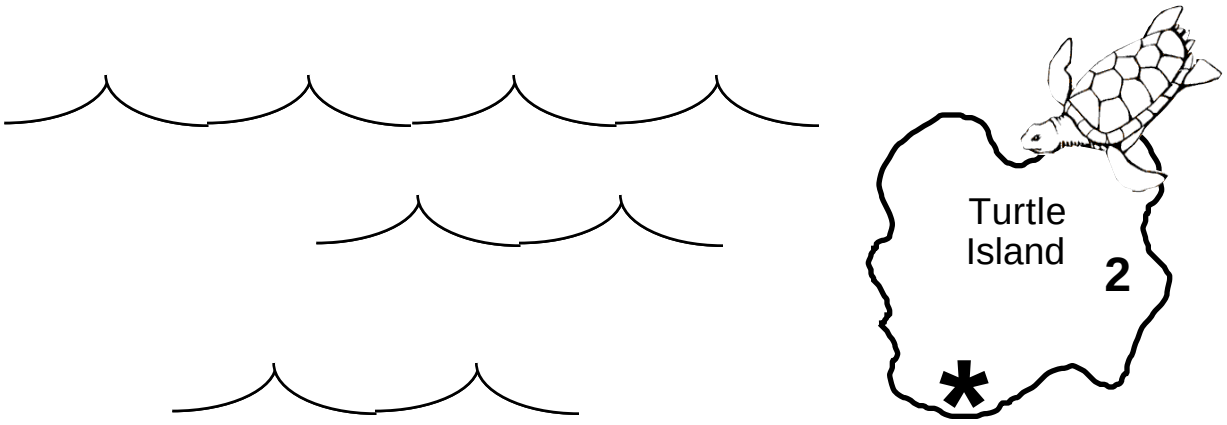
5

Monkey Island

4

Island Hopping Map

Northeast Section



Name _____ Student Resource Sheet #9

Island Hopping

Use your Croc Rods to measure the distance between islands. Place rod on the star when measuring. Record answer and write number fact.

1. Use your yellow Croc Rod. Start at Croc Island, measure the distance to Turtle Island.

   Distance = _____ rods
   Number Sentences _____

   _____

2. Use your orange Croc Rod to measure the distance from Turtle Island to Frog Island.

   Distance = _____rods
   Number Sentences_____

   _____

3. Your boat needs to leave Frog Island to go to Monkey Island for more supplies. Choose a rod that has not yet been used today. You will estimate and then measure the distance using the least amount of that color Croc Rods. Record the estimate and then the actual distance.

   Estimate of distance = _____rods
   Actual Distance = _____rods

   Number Sentences_____

   _____

Counting Crocodiles
Scoring Rubric

Responses to activities demonstrate the student's ability to:

3

- Answer all questions correctly. Shows thorough mathematical reasoning.
- Written response shows words, exact numbers, pictures, and evidence to communicate understanding.
- Evidence of correct measurement.
- Students give correct description of their observation of Croc rods.
- Students clearly answer questions, using supporting mathematics evidence in a clear and concise manner.

2

- Answer most questions correctly. Shows adequate mathematical reasoning.
- Written response cites some supporting evidence and communicates understanding.
- Correct measurement of most of the problems.
- Limited description of the observation of Croc rods.
- Limited explanation of answers on student activity sheet.

1

- Shows limited understanding when answering questions. Shows some mathematical reasoning.
- Limited written response. Answers questions with little supporting evidence.
- Incorrect measurement most problems.
- Inaccurate description of the observation of Croc rods.
- Student does not cite supporting evidence or is unable to communicate their understanding.

0

- Limited mathematical reasoning.
- Limited written response.
- Incorrect measurement.
- Inaccurate description of the observation of Croc rods.
- Incomplete explanation.
- Did not follow directions.